Abstract Submitted
for the GEC14 Meeting of
The American Physical Society

Electron Density Measurement of Argon Containing Plasmas by Saturation Spectroscopy[1] S. NISHIYAMA, H. WANG, S. TOMIOKA, K. SASAKI, Hokkaido University — Langmuir probes are widely used for electron density measurements in plasmas. However, the use of a conventional probe should be avoided in a plasma which needs high purity because of the possibility of contamination. Optical measurements are suitable for these plasmas. In this work, we applied saturation spectroscopy to the electron density measurement. The peak height of the saturation spectrum is affected by the relaxation frequency of the related energy levels. In the case of the metastable levels of argon, the electron impact quenching rate, which is proportional to the electron density, is the dominant factor. In our experiments, an inductively coupled plasma source and a tunable cw diode laser were used. The frequency of the laser was scanned over the Doppler width of the $4s[3/2]_2^o - 4p[3/2]_2$ (763.51 nm) transition. The experimental saturation spectrum was composed of a sharp Lorentzian peak and a broad base component, which was caused by velocity changing collisions. We deduced a new relationship between the saturation parameter and the measured saturated absorption spectrum with considering velocity changing collisions. We confirmed a linear relationship, which was expected theoretically, between the inverse of the saturation parameter and the electron density.

[1]Part of this work is supported by JSPS KAKENHI Grant Number 24540529.

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Date submitted: 11 Jun 2014 Electronic form version 1.4